

SUN WORSHIPPER. McCREADY'S SOLAR CHALLENGER
FLIES OVER THE ENGLISH CHANNEL

Hellmut Penner

NASA-TM-77327 19840008098

Translation of "Sonnenanbeter. McCreadys Solar Challenger
flog über den Ärmelkanal," Flug Revue, No. 9, Sept. 1981,
pp. 67-69.

REVISED VERSION

LIBRARY COPY

MAR 28 1984

LANGLEY RESEARCH CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

LIBRARY, NASA
WASHINGTON, VIRGINIA
DECEMBER 1983



NF00310

1. Report No. NASA TM-77327		2. Government Accession No.		3. Report's Catalog No.	
4. Title and Subtitle SUN WORSHIPPER. McCready's Solar Challenger Flies over the English Channel				5. Report Date December 1983	
7. Author(s) Hellmut Penner				6. Performing Organization Code	
9. Performing Organization Name and Address Leo Kanner Associates Redwood City, California 94063				8. Performing Organization Report No.	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration, Washington, D.C. 20546				10. Work Unit No.	
13. Supplementary Notes Translation of "Sonnenanbeter. McCreadys Solar Challenger flog über den Ärmelkanal," Flug Revue, No. 9, 9/1981, pp. 67-69.				11. Contract or Grant No. NASW-3541	
16. Abstract The background for the project of a solar-powered aircraft, designed and built by Dr. Paul McCready of California, is reported with details on the aircraft design and its flight across the English Channel.				13. Type of Report and Period Covered Translation	
17. Key Words (Selected by Author(s))				14. Sponsoring Agency Code	
19. Distribution Statement Unclassified - Unlimited					
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 22.	

N-154,106
N84-16166#

SUN WORSHIPER. McCready's Solar Challenger
Flies over the English Channel

Hellmut Penner

The designs of Dr. Paul McCready, who has been experimenting for years with ultra-light airplanes, are attracting more and more interest. His latest success: his pilot, Stephen R. Ptacek flew across the English Channel on July 7 in a plane that was driven electrically and powered by solar cells.

/67²

Only 2 years have passed since Dr. McCready became known because of the spectacular flight of one of his designs: on June 12, 1979, Bryan Allen on board the Gossamer Albatros pedalled across the seas of the English Channel, 5 meters above the water. The designer was presented with the Kramer award endowed with 400,000 marks for this first muscle-powered flight. The money was shared by the team. The route was 35 kilometers long from England to France. Now the solar airplane has flown in the opposite direction, from France to England, with the sun behind it.

Challenger, as he called this plane, was built with the assistance of the American chemical company DuPont, which put more than 600,000 dollars into the project. This is a tremendous expenditure when measured against the 200,000 marks spent by Guenter Rochelt from Munich to almost beat McCready with his Solair I (Flug Revue 3/1981).

But Dr. Paul McCready, former gliding champion, led his team to success at a pace as consistent as his appearance has been self-confident. From the beginning McCready collaborated with DuPont which had already sponsored his projects of the Gossamer Condor, Gossamer Albatros and Gossamer Penguin, the forerunner of Solar Challenger. In Pasadena, in sunny California, Dr. McCready runs his own research company and there the projects originated. The

* Numbers in the margin indicate pagination in the foreign text.

secret: the ingenious engineer and glider pilot gambles on alternative energies. The muscle-powered aircraft had to prove that it was possible to fly using human power. With solar propulsion, the American believes he can find a way out of the oil shortage.

The real results are reflected, however, in aerodynamics and airplane construction. Although the triumphant success, with certain access into the Guinness Book of Records, proves the correctness of this concept, the idea used by the Californian was rather well-known.

The wing of the Solar Challenger is stabilized by means of a conventional cross tail unit. The engine is mounted conventionally in front of the pilot's gondola. Janus seems to have been the originator of the landing gear design.

/68

Progress can be found in invisible details. Peter Lissaman, an employee of the McCready company, Aerovironment Inc. in Pasadena, had the task of developing a special wing section that has a flat surface on its upper side for accomodating the solar cells. As a result, the tail section profile, first of all, is the exact opposite of conventional models: there is a stronger curvature on the bottom side, while the upper side seems to be as flat as a board. The airfoil profile is similar.

Although the forerunner models were a jungle of wires, the Challenger makes a more progressive impression. McCready used in its construction the most modern materials, such as aramid-fiber Kevlar, carbon fiber, dacron, Nomex honeycomb, Mylar foils, Delrin and nylon, Lucite and Tedlar. Metals were used almost exclusively at joining points. A few wires of high-strength alloys provide the flight craft more static support.

In order to achieve the goal of crossing the Channel, it was necessary to consider all details. It was important to have a plane that would be aerodynamically and statically stable, capable of withstanding plus 6g and minus 4g. The heavy bird,

weighing 98.4 kilograms, had to have a wing span of 14.8 meters.

On the available solar surface of 18.6 square meters, 16,126 solar cells were installed for driving an electrical motor with a power of 2,700 watts. This motor lies in the cooling area of the propeller. McCready was obliged to use a motor supplied under the Astro Flight company sponsorship; its construction consists of two motors coupled in series. Their power is transmitted through a belt pulley on two vee belts and a supplementary gear that drive a propeller of three meters in diameter. According to experts, the efficiency of this motor is below technical standards.

Outdated Tubular Spar

The tail unit spar, wound from carbon and Kevlar fiber and Nomex, is coupled in the extension of the motor support. The vertical tail unit, elevators and stabilizers and wings are of similar construction: the spars consist in each case of a carbon core, coated with Nomex honeycomb and several layers of wound Kevlar fiber. The supporting material Nomex was not used only in small cross sections.

McCready did not make use at all of the much lighter spars in his construction, but used tubular spars for the wing and tail plane, presumably in order to absorb the torsional forces more easily.

Nevertheless, it is a fact that the Americans generally prefer tubular spar structures. The knowledge of German glider manufacturers gained in applying very light spars of carbon fiber box structures in many models, obviously did not yet reach their design offices. Other high-load structures, such as the pilot's gondola, which together with the landing gear has to absorb the landing shocks, are constructed almost exclusively of carbon fiber tubes attached to one another with adhesives.

A glued joint was applied here for the first time, employed until now only in the construction of models. The tubular sections to be joined were simply glued together by means of a fiber roving. A similar method was used for fastening the stabilizers and elevators. All aerodynamically working surfaces have foam material ribs on their tubular spars, reinforced by means of Kevlar and carbon fibers. The covering is of Mylar film, basically very transparent and temperature stable.

The solar cells, approximately 16,000 in number, producing up to 4,800 watts of electrical energy by solar radiation, are laid on elastic synthetic material and covered with a very thin Mylar foil. They make up a substantial part of the total weight of the plane. In case of mechanical damage to a single cell, no more current flows and the bird has to make use of its limited gliding capacity or land. The Californian team had worked for the last year to achieve its goal, the first flight. In December 1980, in the same month but some days earlier than the date for take-off of the German solar aircraft Solair I, they were ready. Dr. McCready advertised for a possible "lightweight" girl and found her. She was Janice Brown, a 32-year old pilot, who had enough experience in flying and weighed only 48 kilograms. She was also successful in the first Solar Flight.

169

Failure of First Attempt

During the next months she surpassed her own records many times. In May 1981, she even managed to stay in the air for more than 7 hours. She thus became a member of a select team of pilots; its second member was 28-year old Stephen R. Ptacek. Ptacek is, so to speak, an all-around pilot with basic training in gliding. He had spent, up to now, 4,700 flight hours on transport aircraft, business jets, gliders, towing craft and spray aircraft.

Until their arrival in Europe in June, it was not decided which of the two candidates was to fly across the Channel. The great event was planned, virtually, for the occasion of the Air

Show in Le Bourget. The Solar Challenger was exhibited for several days before in the Air Museum. The schedule provided for the flight from France to England to occur during the period from June 14 to July 1. Northwest of Paris is a former NATO airport at Corneille-en-Verin and its 3-kilometer runway was thought to be sufficient for the take-off of the precious bird.

On June 21, the first attempt to fly to England in hazy weather, and with a helicopter carrying photographers flying too close, failed after 10 kilometers.

For July 7, the meteorological forecast was for a large Azores high with main wind direction from the South. Stephen R. Ptacek was finally appointed the pilot. Preparations for the take-off began early in the morning. Shortly after 9:00 a.m. the 54-kilogram lightweight Ptacek mounted the solar aircraft and took off at 9:28 a.m. in the direction of the Channel coast. At 9:42 a.m. he already reported an altitude of 800 meters above the Corneilles-en-Verin airport. At 30 meters per minute he climbed up to the altitude of 3,566 meters. After 5 hours and 23 minutes, he landed at 2:51 p.m. at the Manston Royal Air Force Base near Kent, south of London.

The Channel Flight Was a Team Effort

The flight across the Channel itself lasted only one hour and 25 minutes. For 21 minutes prior to landing, he circled over the airport in order to give the photographers time to take pictures before he landed. The flight was assisted by only one airplane. For safety reasons, Ptacek chose the higher altitude. Over the distance of 261 kilometers he maintained a speed of 64 kilometers per hour. During his flight across the Channel, Ptacek remained at an altitude of 3,350 meters, high enough to reach the coast safely in a straight gliding flight in the case of a motor failure or overcast sky. Additionally, thermals had also been taken into consideration, becoming active at noon.

In contrast to the customary record and pioneer flights or

other records, this flight across the Channel was a group achievement. The fine team, provided with the best financial means, set itself a task that perhaps ranks as one of the last great adventures in the world of aeronautics.

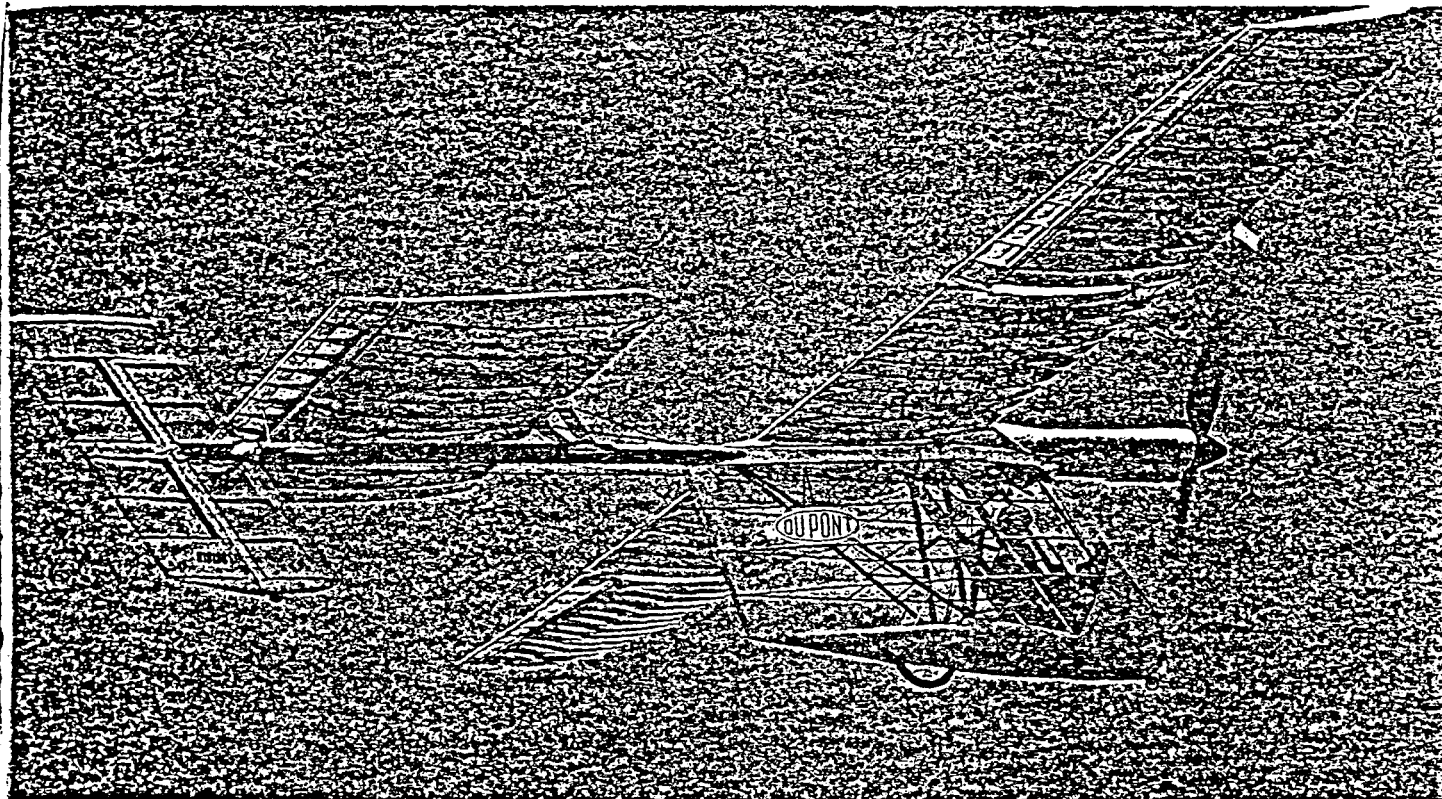
It is still a question whether McCready will now conquer the Atlantic using a new, more efficient design. Marketing the experience gained should not be excluded. There is also the question of whether he really found an economic means for future aircraft engines. According to physical laws, it is difficult to exceed the efficiency of a solar cell, and they can only get more inexpensive. The power demands for a hovering flight of a conventional glider are approximately 10 kilowatts, equivalent to 40 square meters of solar area; however, a glider has no more than 10 to 12 square meters of wing area. The tragic consequence: both solar airplanes may remain the only ones.

Technical Data of the Solar Challenger

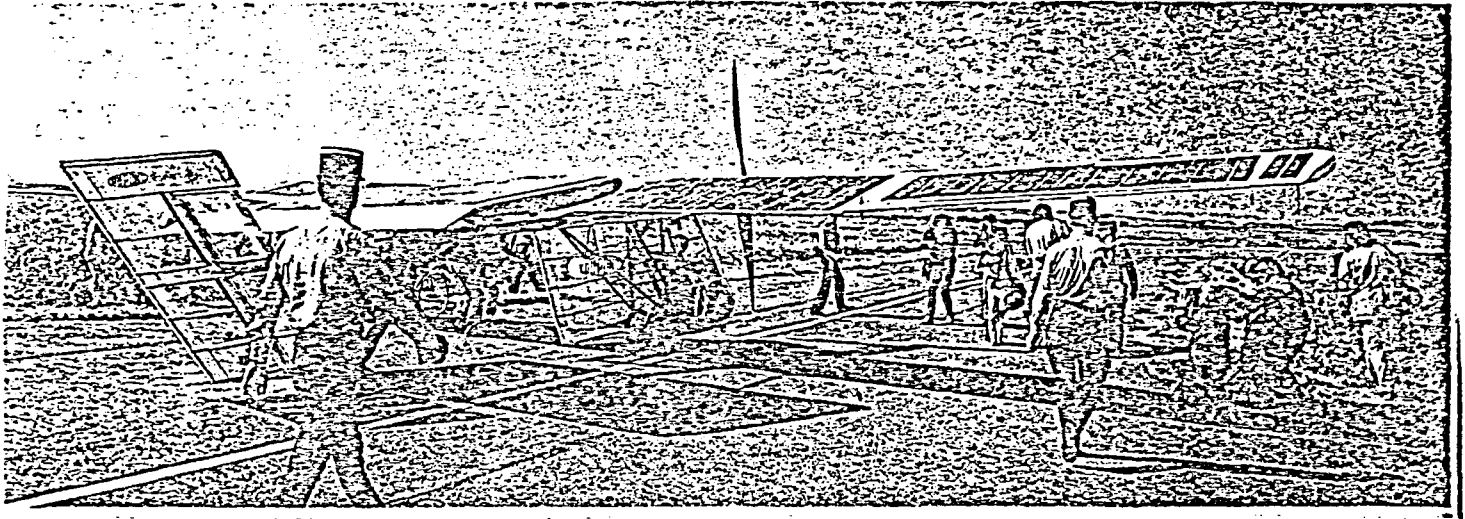
Wing span	14.18 m
Length	9.22 m
Weight	98.4 kg
Flight weight, with pilot	152.8 kg
Airfoil area	18.6 m ²
Output of electric motor with 16,128 solar cells	2.7 kW
Breaking load	+ 6g, - 4g
Steering - aerodynamic, controlled in 3 axes, (conventional)	
Propeller, diameter 3 meters, controllable pitch	300 r.p.m.
Max. flight speed	64 km/h
Cruising speed	40-55 km/h
Minimum flight speed	27 km/h
Rate of climb	30 m/min

The Record Paris-London Flight on July 7, 1981

Pilot	Stephen R. Ptacek, 28
Duration	5 hours, 23 minutes
Max. altitude achieved	3,566 meters
Max. speed over ground	75 km/h
Distance covered	261 kilometers
Place of take-off	Pointoise/Corneille-en-Vexin, France
Place of landing	Manston Royal Air Force Base, Kent, U.K.



Remarkably Modern Appearance with a Conventional Design:
Solar Challenger Crosses the Channel.



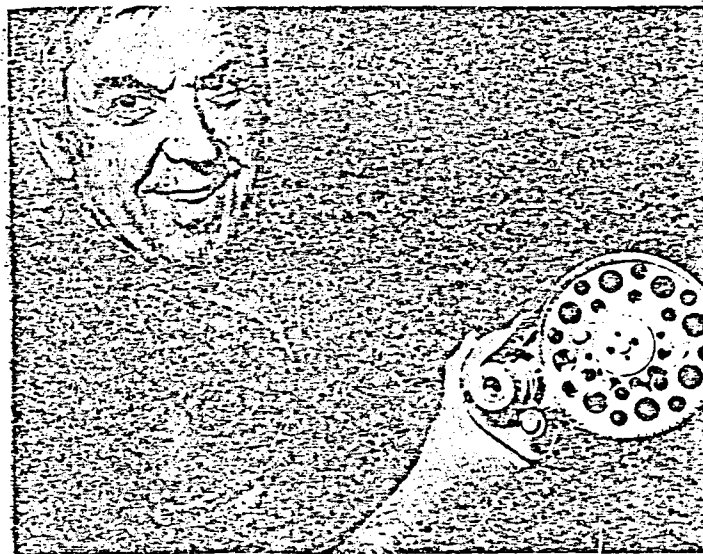
Solar Challenger Undergoing Tests: 16,126 Solar Cells
on its Back Producing 4,800 watts.



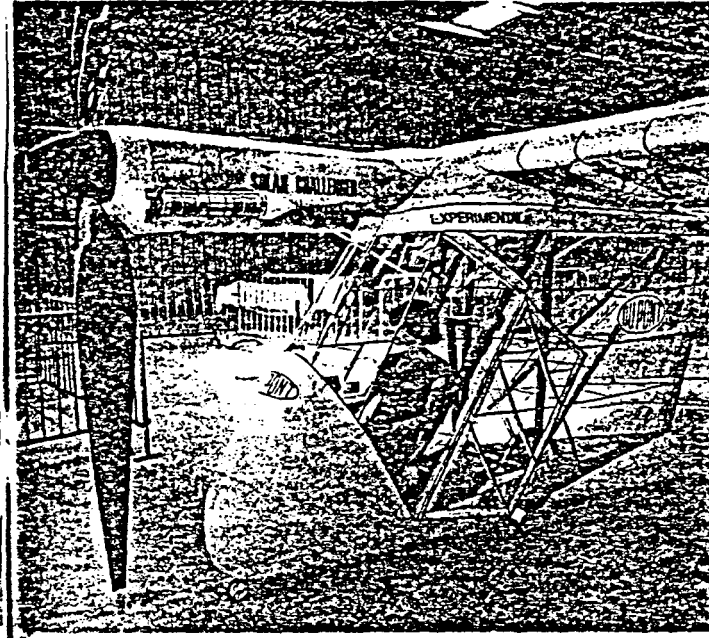
The All-Around Pilot for the Channel Flight:
Stephen R. Ptacek.



The Bold Designer of the Solar
Challenger: Paul McCready.



The Early Pioneer of Solar Technology
and Member of the Successful McCready
Team: Robert R. Boucher.



The Lightweight Woman-Pilot for
the First Solar Flight: Janice
Brown.

End of Document